



NASA STTR 2007 Phase I Solicitation

T2 Atmospheric Flight Research of Advanced Technologies and Vehicle Concepts

Flight Research separates "the real from the imagined" and makes known the "overlooked and the unexpected." NASA's flight research mission is to prove unique and novel concepts through discoveries in flight. The chief areas of research interests encompass aerospace flight research and technology integration; validation of space exploration concepts; airborne sensing and science; and mission support for the Shuttle and International Space Station. This topic solicits innovative proposals that would advance aerospace technologies for the nation in all flight regimes.

Subtopics

T2.01 Aerospace Vehicles Flight Dynamic Modeling and Simulation

Lead Center: AFRC

This subtopic solicits proposals for innovative, linear or non-linear, aerospace vehicles dynamic systems modeling and simulation techniques. In particular:

Research and development in simulation algorithms for revolutionary aerospace flight projects involving computational fluid dynamics (CFD), structures, heat transfer, and propulsion disciplines: Emphasis is placed on the development and application of state-of-the-art, novel, and computationally efficient solution schemes that enable effective simulation of complex modern flight vehicles, like the Space Shuttle, the Constellation (Aries and Orion), light-weight highly flexible structures, as well as more routine problems encountered in recurring atmospheric flight testing on a daily basis. Furthermore, the effective use of high-performance computing equipment and computer graphics development is also considered an important part of this topic.

Aeroelasticity and aeroservoelasticity, linear and non-linear: Vehicle design and stability analysis are an important aspect of this topic. Primary concern is with the development and application of novel, multi-disciplinary, simulation

software using finite element and other associated techniques.

T2.02 Foundational Research for Aeronautics Experimental Capabilities

Lead Center: AFRC

This subtopic is intended to be broad and to solicit and promote technologies for the following:

- Automated online health management and data analysis;
- 21st Century air-traffic management;
- Modeling, identification, simulation, and control of aerospace vehicles in-flight test, flight sensors, sensor arrays and airborne instruments for flight research, and advanced aerospace flight concepts.

The emphasis of this subtopic is the feasibility, development, and maturation of advanced flight research experiments that demonstrate advanced or revolutionary methodologies, technologies, and concepts. It seeks advanced flight techniques, operations, and experiments that promise significant leaps in vehicle performance, operation, safety, cost, and capability; and that require a demonstration in an actual-flight environment to fully characterize or validate advances.

Proposals in any of these areas will be considered.

Online health monitoring is a critical technology for improving aviation safety. Safe, affordable, and more efficient operation of aerospace vehicles requires advances in online health monitoring of vehicle subsystems and information monitoring from many sources over local and wide area networks. Online health monitoring is a general concept involving signal-processing algorithms designed to support decisions related to safety, maintenance, or operating procedures. The concept of online emphasizes algorithms that minimize the time between data acquisition and decision-making.

The challenges in Air Traffic Management (ATM) are to create the next generation systems and to develop the

optimal plan for transitioning to future systems. This system should be one that seamlessly supports the operation of ROAs. This can only be achieved by developing ATM concepts characterized by increased automation and distributed responsibilities. It requires a new look at the way airspace is managed and the automation of some controller functions, thereby intensifying the need for a careful integration of machine and human performance. As these new automated and distributed systems are developed, security issues need to be addressed as early in the design phase as possible.

Safer and more efficient design of advanced aerospace vehicles requires advancement in current predictive design and analysis tools. The goal is to develop more efficient software tools for predicting and understanding the response of an airframe under the simultaneous influences of structural dynamics, thermal dynamics, steady and unsteady aerodynamics, and the control system. The benefit of this effort will ultimately be an increased understanding of the complex interactions between the vehicle dynamics subsystems with an emphasis on flight test validation methods for control-oriented applications. Proposals for novel multidisciplinary nonlinear dynamic systems modeling, identification, and simulation for control objectives are encouraged. Control objectives include feasible and realistic boundary layer and laminar flow control, aeroelastic maneuver performance and load control (including smart actuation and active aerostructural concepts), autonomous health monitoring for stability and performance, and drag minimization for high efficiency and range performance. Methodologies should pertain to any of a variety of types of vehicles ranging from low-speed, high-altitude, long-endurance to hypersonic and access-to-space aerospace vehicles.

Real-time measurement techniques are needed to acquire aerodynamic, structural, control, and propulsion system performance characteristics in-flight and to safely expand the flight envelope of aerospace vehicles. The scope of this subtopic is the development of sensors, sensor systems, sensor arrays, or instrumentation systems for improving the state-of-the-art in aircraft ground or flight-testing. This includes the development of sensors to enhance aircraft safety by determining atmospheric conditions. The goals are to improve the effectiveness of flight testing by simplifying and minimizing sensor installation, measuring new parameters, improving the quality of measurements, minimizing the disturbance to the measured parameter from the sensor presence, deriving new information from conventional techniques, or combining sensor suites with embedded processing to add value to output information. This topic solicits proposals for improving airborne sensors and sensor-instrumentation systems in all flight regimes - particularly transonic and hypersonic. These sensors and systems are required to have fast response, low volume, minimal intrusion, and high accuracy and reliability.